OBJECT-ORIENTED AUTOMATIC UNSTRUCTURED SURFACE MESH GENERATION

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Surface grid generation is still a challenging task in industry today. Especially for complex aircraft configurations the generation of an unstructured surface mesh of sufficient quality is still a very time consuming part, because a large amount of human interaction is required. This is due to the geometry cleaning/repair operations to be done to produce a watertight model, and due to the setup time needed to define the local edge lengths necessary to resolve all important geometrical features adequately.

In this paper a new object-oriented (OO) surface mesh generation system is described enabling the automatic and parallel generation of high quality surface grids based on the advancing front method [1]. The main software components are illustrated and the advantages of the OO design and implementation are highlighted. Supported geometry import formats are: NASA-IGES, STEP and FLITE format. Various parametric curve and surface types (Ferguson, Bezier, NURBS) are transparently available with an abstract interface. To achieve a fully automatic surface meshing, a geometry rasterization process had been developed [2]. The outcome of this rasterization is a smooth edge length distribution over the complete computational domain, mandatory to resolve all the geometrical features up to a user-specified tolerance. Fast turn-around time is achieved by the parallel execution of the computational intensive parts. The parallelisation concept based on the MPI standard is presented and performance figures are given. The examples shown at the end of the paper demonstrate the capabilities of this approach: fighter-type aircraft (2750 NURBS faces, 2.1 million triangles, 6.24 [min] for rasterization on 16 XEON CPUs (2GHz), 6:40 [min] for mesh generation on 32 XEON CPUs, this corresponds to a parallel speed-up of about 20).

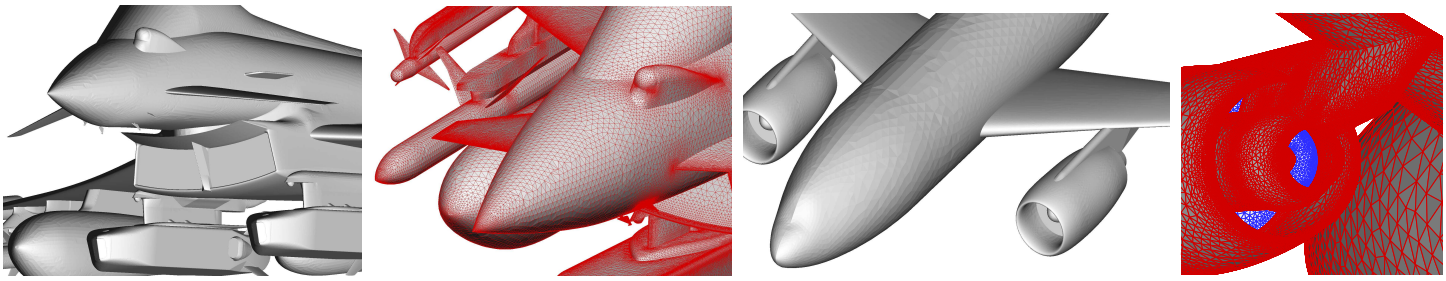

Figure 1: Advanced fighter-type aircraft (left) and transport aircraft (right) configurations.

References

[1] J. F. Thompson, B. K. Soni, and N. P. Weatherill, eds., *Handbook of Grid Generation*, CRC Press LLC, 1999.
[2] F. Deister, U. Tremel, E. H. Hirschel, and H. Rieger, "Automatic Feature-Based Sampling of Native CAD Data for Surface Grid Generation," to appear in *Numerical Notes on Fluid Mechanics*, Springer Verlag, Berlin, 2003.
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